SCIENCE INFORMATION SYSTEMS NEWSLETTER

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Welcome to Issue 43

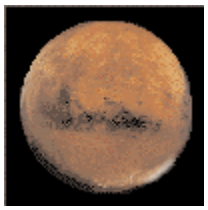
1997

The NASA Science Information Systems Newsletter (SISN) is prepared for the Office of Space Science (OSS), Science Information Systems (SIS) Program through an agreement with the Jet Propulsion Laboratory. The newsletter, which has been an ongoing task for over ten years, is a forum for the space science and applications research community to report research and development activities, outreach activities, and technology transference. SISN offers a venue for articles that are not likely to appear elsewhere and provides the opportunity for information exchange within the science community, as well as a platform for accomplishments by that community. Related articles from other programs and agencies are also published.

Questions or comments regarding this newsletter task may be sent to <sandi.beck@jpl.nasa.gov>.

Credits: Design and format by Editor, Sandi Beck. Graphics design, animation, and rollovers by Scott Brenneisen, XTREME GRAFX. Also, thanks over the years to Calvin Yee, formerly of Telos Information Systems, Doug Steinwand, formerly of JPL, and the JPL documentation staff.

Landing on Mars, and Roving Around



On July 4 Mars Pathfinder (MPF) is scheduled to land on an ancient flood plain on Mars called Ares Vallis. This site is 850 kilometers (527 miles) southeast of the Viking Lander 1 location in 1976, the first Mars landing, 20 years ago. The landing site is 200 kilometers at its widest point by70 kilometers at its longest point.

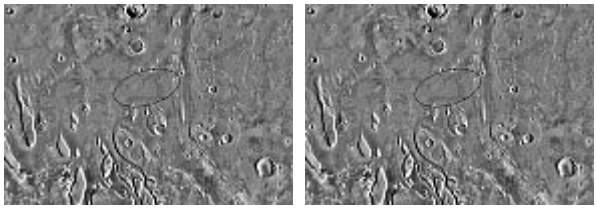
MPF, the first US mission to send a roving vehicle onto the Martian surface, is the second of NASA's Discovery Mission series. It is designed to foster rapidly developed, low-cost spacecraft with highly focused science objectives. MPF's purpose is to demonstrate an inexpensive system for cruise, entry, descent, and landing on Mars. Other objectives for this mission are to demonstrate 1) a simple, low-cost system, at a fixed price for placing a science payload on the Mars surface at considerably less than the cost during the Viking mission, and 2) the mobility and usefulness of a microrover on the Martian surface. Landers and rovers of the future will benefit from the heritage of this mission.

Selecting the site

More than 60 scientists from the US and Europe participated in selecting this landing site <http://nssdc.gsfc.nasa.gov/planetary/marsland.html> after studying the science objectives and engineering considerations. The chosen site, near the mouth of a catastrophic flood channel, is called a "grab bag" by scientists due to its potential for sampling a wide variety of martian crustal materials. The engineering considerations related to landing safely and encompassed the need for sufficient sunlight, acceptable slopes, surface roughness, low elevation for sufficient atmospheric density, low dust storm potential, etc. Because the spacecraft are solar-powered, the best landing site is one with maximum sunshine. Project Manager, Anthony Spear, explained that this July the Sun will be directly over the 15 degrees north latitude region of the planet.

"The elevation must be as low as possible," Spear said, "so the descent parachute has sufficient time to open and slow the lander to the correct terminal velocity. The landing will be within a 100-by-200-kilometer (660-by-120-mile) ellipse around the targeted site due to uncertainties in navigation and atmospheric entry

A giant cocoon of airbags will inflate seconds before the landing, to cushion the impact. According to Brian Muirhead, MPF flight system manager at Jet Propulsion Laboratory (JPL), this is a new landing method; the first time a US mission will use airbags to absorb the shock and protect the lander from the target surface.



Images landing site, courtesy of National Space Science Data Center

Science objectives

MPF's lander carries an atmospheric structure instrument/meteorological package that will make observations during its descent to the surface and take meteorological measurements on the surface. The lander will also function as a weather station, a radio relay station for the rover, and will be used by the Deep Space Network to examine the rotational and orbital dynamics of Mars.

After the landing and checkout, the rover's onboard science instruments package will investigate the Martian surface. A stereoscopic imager with spectral filters on an extendible mast will reveal the mineralogy of surface materials, as well as the geologic processes and surface-atmosphere interactions that created and modified the surface. An alpha proton x-ray spectrometer will examine the composition of the rocks.

Examination of the different surface materials will allow first-order scientific investigations of the early differentiation and evolution of the crust, the development of weathering products and the early environments and conditions that have existed on Mars.

- the geology and surface morphology at sub-meter to a hundred meters scale
- the geochemistry and petrology of soils and rocks
- the magnetic and mechanical properties of the soil, as well as the magnetic properties of the dust
- a variety of atmospheric investigations and rotational and orbital dynamics of Mars

Landing sequences

On June 30 MPF will be approximately 1 million miles from Mars, traveling at a velocity of about 1,000 miles per hour with respect to Mars. On July 4, MPF will begin cruise stage separation and will enter the upper atmosphere of Mars, beginning the sequence of events that will land the spacecraft on the surface. Entry, descent, and landing (EDL) will take approximately 4.5 minutes. To learn more about EDL access MPF's EDL web page <http://mpfwww.jpl.nasa.gov/mpf/edl/edl1.html>. EDL sequence is:

- spacecraft rapidly decelerates in the atmosphere using the heatshield
- parachute deploys
- heat shield separates

- lander releases from backshell, descends on bridle
- radar altimeter returns information on altitude
- airbags inflate
- rocket-assisted deceleration engines fire
- bridle cable is cut

The landing will take place mid morning (approximately 10:07 AM), shortly after which the transmitter is turned off to save power. The lander will bounce, perhaps as much as ten stories high, and roll to a stop. The airbags will deflate and are retracted up against the petals. The petals will then open. At the completion of this sequence, a signal, called a semaphore, may be received via the lander's low-gain antenna.

When the transmitter is turned back on, the spacecraft will signal Earth through the low-gain antenna. This communication session will contain telemetry from all engineering subsystems, including the rover, and the first science data about the atmosphere taken during the lander's descent.

If all subsystems check out "normal," the mission will follow the nominal plan. The highest priority is to assure the safety of the spacecraft and rover, to insure enough power for operations, and to recharge the battery. Contingency scenarios are planned.

Sol 1

A Sol is a Mars day, or 24 hours, 40 minutes. Sunrise at the landing site is at 2 PM, at which time operations begin for Sol 1. If the mission follows the nominal plan, the camera on the lander will be released to begin searching for the Sun. The high-gain communications antenna is then deployed and pointed toward Earth. The first engineering images of lander, airbags, and the region around the lander will be transmitted during the first high-gain antenna downlink session. However, the lander imager's Sun search and the high-gain antenna deployment must be completed successfully for the images to be received.

In the evening, the low-gain antenna downlink session begins, sending approximately 12 images. At this time the rover team will evaluate the feasibility of ramp deployment. If all conditions are judged acceptable, the rover deploy sequence will be activated and the rover will drive off the lander petal, down a ramp, rolling onto the Martian surface. The alpha proton x-ray spectrometer will then be lowered onto the soil to prepare for deployment.

A third high-gain antenna downlink session will take place that will show images of the rover on the surface. From these images, the spectrometer deployment may take place. Other images sent may include a 360 degree panorama of the landing site.

After the Sun sets on the landing site, the rover will go to sleep. If the spectrometer has been deployed, it will be taking measurements of rock and soil composition and storing data throughout the night.

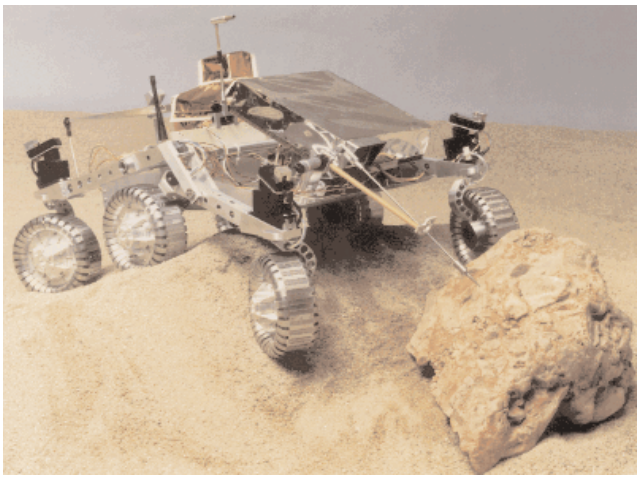
Sol 2

Key Activities on Sol 2 include obtaining and partially returning a color stereo panorama image and performing an extended rover traverse. Also, the rover will conduct several experiments with soil mechanics during this traverse, and may attempt a second measurement with the alpha proton x-ray spectrometer at the end of the day.

Additional transmission sessions may occur depending on available power. Expected data during these sessions include engineering telemetry, weather observations, image data from the stereo color panorama, and images acquired by the rover. You may replay MPF's cruise engineering data online at <http://mpfwww.jpl.nasa.gov/mpf/realtime/replay.html>.

Rover technology

When the rover is deployed it will become the first vehicle to travel on another planet and the first to go outside of Earthsince the Apollo 17 astronauts drove their larger vehicle on the moon in 1972. The difference this time is, of course, that the driver will be 200 million kms (120 million miles) away.



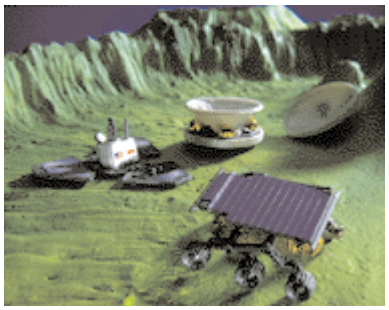
Marsrover

Brian Cooper of Jet Propulsion Laboratory (JPL), the developer of the rover control workstation software, will be the first to observe where Sojourner is on Mars. As scientists determine the best target areas to send Sojourner, Cooper or backup driver, Jack Morrison, will then "drive" the rover by uplinking a sequence of commands.

To prepare for these real-time activities, Cooper and Morrison used special goggles that allowed them to view stereo imagery in 3D. This gave them the depth perception to see items in relation to each other in order to make decisions based on what they were viewing. During operational readiness tests mock images of the Martian terrain were displayed. Because the cursor on the workstation is an image of the rover, Cooper could evaluate the rover's position in correct perspective to the rocks on the mock surface.

Another simulated Mars environment is the Mars yard at JPL. This area, a simulation of the rocky terrain of the planet, has been used for physically testing prototype rovers.

Rover technology to date has yielded innovations in miniature electronics, suspension, robotics, and in many other fields. One serendipitous product is a toy version of the six-wheeled Sojourner by Mattel Inc. The company's Hot Wheels JPL Sojourner Mars Rover Action Pack Set is a toy version of the MPF rover. The toy recreates the real robot's "rocker-bogie" locomotion system. Members of the Technology Affiliates Program at JPL hope the toy becomes a hit as a way to get the public enthused about the space program and the technology derived from it.



Mattel Inc. Hot Wheels JPL Sojourner Mars Rover Action Pack Set

Activities and public access

Dozens of Internet sites around the world will provide the public with up-to-the-minute reports on the status of the MPF approach and EDL, and the deployment and surface activities of the rover. These sites will also feature images of the Martian surface as they become available. More than 25 million hits are expected on July 4. Check the MPF homepage <http://mpfwww.jpl.nasa.gov/> to select a mirror site closest to you. Also, anyone with a satellite dish may acquire the NASA TV signal by select the GE-2 satellite, transponder 9C, 85 degrees west longitude, vertical polarization, audio frequency 3880 MHz, audio subcarrier 6.8 MHz, horizontal polarization.

Hundreds of journalists from over 100 news services are expected to be begin converging on JPL on June 30 to cover Pathfinder's landing. Major television networks are expected to broadcast events throughout the week. JPL and the California Institute of Technology will set up several closed-circuit viewing venues for over 400 invited guests, MPF team members, and their families.

The Pasadena, California, Rose Bowl in close proximity to JPLwill present a short highlight film on a large-screen television just prior to the annual fireworks display on July 4. Also, the Planetary Society is hosting PlanetFest'97 at the Pasadena Convention Center at which several JPL scientists are scheduled to appear to discuss various current and future missions. PlanetFest'97 will also offer interactive games, exhibits of space art, and screenings of documentaries and science fiction films. To keep up with the latest news on the Mars happening, access "New Flashes" <http://www.jpl.nasa.gov/news/>from JPL.

Material excerpted from JPL, ARC, NSSDC, and MPF web site.

Learn more about the red planet from JPL'S Welcome to the Planets web site <http://pds.jpl.nasa.gov/planets/>and click on Mars. To view a myriad of Mars images, access Ames Research Center's education and outreach site, Quest, and its Mars Photo Gallery <http://quest.arc.nasa.gov/mars/photos/>. To traverse the planet as an "armchair astronaut", go to the Planetary Data System's current HOT TOPIC, Mars Explorer page <http://www-pdsimage.wr.usgs.gov/PDS/public/mapmaker/mapmkr.htm>. To find some cool activities for your young children, such as build a spacecraft or qualify for a Martian driver's license, access the MPF Mars Education and Outreach web page <http://mpfwww.jpl.nasa.gov/mpf/education/educoutr.html>. ■

As NASA gears up for Mars Pathfinder' historic landing on the Red planet, next-generatin prototype robotic rovers are field tested in simulated Mars treks, in the California desert and in a South American desert, the Atacama Desert in northern Chile.

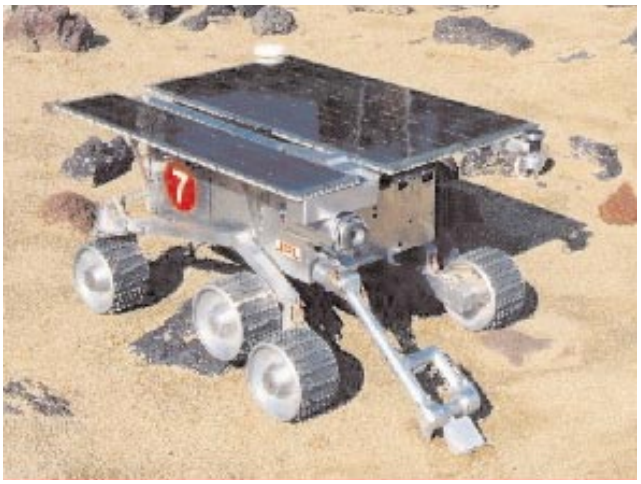
Prototype Rovers Simulate Mars Trek

A week-long series of field tests were carried out May 23-30 on the site of an ancient lake bed, Lavic Lake. The southern side of the lake, located on the Twenty-Nine Palms Marine Corps Base near Palm Springs, California, was chosen as the site of the field tests because it is a playa, analogous to some regions of Mars, with areas of lava flow, cracked mud, terrain strewn with basalt rocks and an alluvial fan.

The tests were designed to simulate several weeks of a real Mars rover mission and to test the rover's ability to drive much greater distances than current rovers. Rocky 7 also conducted five simulated science experiments in real-time and collected samples of soil and rocks, such as would be retrieved and returned to Earth by a later Mars mission.

Rocky 7

The Rocky 7, NASA's newest, six-wheeled prototype Martian rover, represents the latest model of rovers that may be sent to Mars in the years 2001 and 2003. It looks, however, very similar to its predecessor, Sojourner, which will land on Mars on July 4. Rocky 7 weighs slightly more than Sojourner at 33 pounds and has about the same dimensions measuring 19 inches wide by 25 inches long by 12.5 inches tall. Rocky 7 also sports the same six-wheeled chassis and springless "rocker-bogie" mobility system, which allows the vehicle to conform to the contours of the surface and scale objects almost as tall as itself without tipping over.



Rocky 7 microrover

Rocky 7 carried a pair of stereo imagers on the front and back of the vehicle, which acted as its "eyes." The rover was furnished with simulated descent imaging to recreate landing, then asked to deploy its mast and begin each traverse and sequence of imaging and science experiments.

Rocky 7 tests

The rover's travels began on a basalt flow covered with cobblestones resting in a layer of wind-blown silt, which offered a variety of obstacles for the robot to hurdle. Engineers tested some of the rover's new features, such as a 12.5-inch manipulator arm with four degrees of freedom. Mounted on the front of the vehicle, the arm carried a "point reflectance" spectrometer that could be extended four inches in any direction to study the color of various surfaces. In future rover missions on Mars, science instruments on the rover arm will help researchers determine the composition of surface soils and rocks.

"Images and science measurements were obtained in several regions of the basalt flow," said Richard Volpe, chief engineer on the rover development team at JPL. "This pavement of basalt boulders and outcrops offered many terrain obstacles for rover navigation and numerous targets for the rover to measure cobbles and the underlying dust."

Engineers also tested a 4.5-foot, antenna-like mast, which would be deployed once the future rover was out and about on Mars. The mast has three degrees of freedom and can be used in much the same way as an arm to deploy science instruments against rocks or align them in the nadir, or down-pointing, position. Two science instruments, a Moessbauer spectrometer and a nuclear magnetic resonance spectromete, rwere mounted on the mast to study surface rocks with different types of coatings, such as red iron oxide and desert varnish, which might be found on Mars. To carry out the variety of science experiments performed during the week, Rocky 7 had to raise its mast 85 times.

In the second journey, the rover set out over the playa, strewn with craters and ejecta fields, and traveled into a crater. Using its mast and arm, the vehicle was able to measure properties of the mud-cracked floor. Rocky 7 also took images of its own tire tracks to help scientists update its location.

"The rover conducted several long traverses across the playa floor, taking images of the tracks left by its wheels so that we could trace its path," said Raymond Arvidson, science team lead and chairman of the Earth and Planetary Sciences Department at Washington University, St. Louis, Mossouri. "The tracks are used to update positional information, after the observations are completed and help us map out the vehicle's next route."

"Imaging and spectroscopy data were acquired for the fan rocks and fine-grained sediment, and samples of the sediment were collected," Arvidson said. "The data are cur-

rently being analyzed and will be used to fine-tune rover designs and operations and to evaluate what can be learned about ancient lake environments and desert pavement formation."

The last excursion, an obstacle course taking the rover over an alluvial fan extending from the nearby mountains, was the most challenging. There, Rocky 7 was asked to use its science instruments to look for evidence that water had been transported to the sediment and to explore the region for cobbles and boulders that had come from volcanic rocks, just as it will do on Mars some day. By the end of the week, the rover had returned 580 images to remote operators in the field and those stationed at JPL. The field test simulated 32 days of a real Mars rover mission.

"One of the chief objectives of these tests was to test Rocky 7's ability to traverse farther over a wide variety of terrain with more Mars-like characteristics than we did in the last set of tests in December 1996," said Samad Hayati, Rocky 7 task manager at Jet Propulsion Laboratory (JPL). "The rover actually traveled about 80 percent farther than it traveled in the last set of tests, over three distinct terrains, using a minimum of instructions from us to guide its way."

Learn more about the field tests for Rocky 7 by accessing the University of Washington Web site at <http://wundow.wustl.edu/rocky7>.

Student/public field tests

Classrooms across the country and as far away as Finland participated in the Lake Lavic field work the last day. The students conducted a remote-driving test, designed to determine how well the vehicle could be controlled remotely using a World Wide Web operator interface called the Web Interface for Telescience. Six schools in California, Oregon, Georgia, Idaho, Texas, and Finland participated in the exercise to command the rover from their classrooms, as scientists will do one day from their home institutions.

The public was allowed to participant remotely in the field testing of a similar robotic rover developed by Ames Research Center and the Carnegie Mellon Robotics Institue in Pittsburgh, Pennsylvania. This 45-day field test was conducted from June 15 to July 31 in the Atacama Desert of Chile. The robot's onboard panospheric camera provides live 360-degree, video-based still images of the its' surroundings. The images were displayed on large screens at ARC and the Carnegie Science Center in Pittsburgh, where the public had an opportunity to control the rover every day throughout the trek.

Nomad

Nomad was designed and built by researchers at Carnegie Mellon's Robotics Institute. About the size of a small car, the robot weighs 1600 pounds and features four-wheel drive/four-wheel steering with a chassis that expands to improve stability and travel over various terrain conditions. Four aluminum wheels with cleats provide traction in soft sand. Power is supplied by a gasoline generator and enables the robot to travel at speeds up to 20 inches per second. Nomad also contains onboard navigation sensors and computers to enable it to avoid obstacles without relying on a human operator. Besides the onboard camera, the rover carries additional color video cameras to provide stereo vision for detecting obstacles and high-resolution color video cameras for experiments in remote geology, which were conducted by NASA.

Nomad image courtesty of the Carnegie Mellon Robotics Institute.

Nomad tests

The scientists tested the ability of the robot , nicknamed Nomad, to navigate, explore, and perform science tasks remotely during a120-mile trek. "The primary objective of the Atacama Desert Trek was to develop, evaluate and demonstrate a robot capable of long distance and long duration planetary exploration," said David Wettergreen, ARC project manager.

Chile's Atacama Desert, a cold, arid region located above 7000 feet, was chosen for the field experiment because its harsh terrain is analogous to that found on Mars and the Moon. The desert's barren landscape features craters, rocks and loose sand without any vegetation due to the lack of rain.

"This site is pretty much what we expect to find on Mars," said Nathalie Cabrol, the expedition's NASA science team leader.

Cabrol explained that the goal was to simulate several NASA planetary exploration missions, which will provide good training for future missions. During different phases of the test the robot was configured to simulate wide-area exploration of the moon, the search for signs of past life on Mars, and the gathering of meteorite samples in the Antarctic. According to Dave Lavery, Telerobotics Program Manager at NASA Headquarters in Washington, DC, this constitutes a really unique and challenging experiment. The project was funded by NASA with in-kind support from corporate sponsors and educational foundations

Continued exploration

Continued robotic exploration of Mars in the next century will focus on the search for water and evidence to confirm hints that life may have existed once in Mars' early history.

Successive Mars missions will be designed not only to examine the planet's composition, atmosphere and weather, but also to identify natural resources that could be mined and used for eventual human expeditions to the red planet.

Material on Rocky 7 and its field test provided by Diane Ainsworth, JPL.The Rocky 7 rover development and field testing was supported by JPL's Robotics and Mars Exploration Technology Program Office for NASA's Office of Space Science, Washington, DC. Material on Nomad provided by John Bluck, ARC.

Learn more about rover development for future Mars missions at <http://telerobotics.jpl.nasa.gov/tasks/scirover>. ■

Progress Report for Next Generation Internet

In one of the first steps to unclog today's Internet and to make a new one that is a thousand times faster for 21st century researchers, NASA held an industry briefing for more than sixty companies at Techmart in Santa Clara, California, June 5.

"Although much of the research needed to make a new, super fast Internet is too risky and too long-term for the private sector, our success will depend on partnerships with private industry and universities," said Christine Falsetti, Next Generation Internet (NGI) project manager at Ames Research Center (ARC).

A major goal is to develop at least two Internet testbeds connecting universities and federal research laboratories. One testbed of about a hundred universities is projected to be about a hundred times faster than today's Internet. A second testbed will include approximately 10 sites and will run about a thousand times faster than the Internet. The two testbeds will also be connected to each other.

Another goal is to make 'co-laboratories' by linking laboratories, computers, data bases and scientists from around the world via the new internet to do research faster and better. These virtual laboratories could be set up quickly to provide universal access to unique scientific facilities across the nation, according to Falsetti.

"Ultimately, the Next Generation Internet will have a huge beneficial economic impact after network speed increases and new service advances are migrated to today's Internet," said ARC's Director, Henry McDonald.

Bottlenecks in today's Internet include the router boxes that send signals from one city or place to another. Also, personal computers and scientific computers called 'work stations' have parts that slow computer information flow.

"We want a network for researchers that is fast from 'end to end.' We will work with private companies on 'routers,' switchers and computer work stations that will send computer information much faster than today's machines can send it," Falsetti said. "Faster computer communications lines will be needed in years to come, as well."

Private industry participants attending the briefing were interested in making faster routers, switchers, and other networking technologies. Some expressed interest in new uses or 'applications' for the new internet, such as telemedicine, video teleconferencing, distance learning, environmental monitoring, and virtual scientific research. A workshop for companies mostly interested in new uses for NGI is being organized for September at ARC.

Excerpted from NASA press release 97-46AR supplied by John Bluck, ARC.

Learn more about NGI at <http://www.ngi.gov>. ■

Mission to Planet Earth Aids Solution to African Hunger

Catherine E. Watson and Ann C. Gaudreaux , Langley Research Center

In refugee camps in East Africa, women and children often must search for hours to find enough firewood to cook for their families. In some African cities, the urban poor spend more than half their annual income on cooking fuel. To help solve this problem, volunteers are using data generated by Mission to Planet Earth (MPTE) program to help the people of East Africa learn to cook using solar energy.

"We have found the NASA Surface Solar Energy data set to be a wonderful resource, providing reliable data for any location on Earth," said Jay Campbell, a director for the non-profit Solar Cookers International (SCI), Sacramento, California, a group that promotes the use of solar cooking technology worldwide.

SCI manages solar cooking training in eight refugee camps and less developed areas, and responds to requests for information from individuals worldwide. According to Campbell, the Surface Solar Energy (SSE) data set has become invaluable to SCI in choosing sites where solar cooking will be most useful to the local population.

"This quality of information is simply unavailable from other sources, and allows us to make better decisions for our consultations and project plans," he said.

In addition to being a relatively cheap heat source, solar cooking reduces smoke, air pollution and deforestation; is clean, convenient and safe around children; and also can be used to pasteurize drinking water to help prevent disease.

"Unfortunately, about 40 percent of the people in the world have no electricity," said Charles Whitlock, a senior research scientist at Langley Research Center, who led the team that developed the SSE data set. "We hope that the data can be used to improve designs of solar-assisted power systems to give electricity to some of these people."

According to Whitlock, the present SSE data also are expected to allow more efficient design of solar-assisted electricity systems for homeowners, communications stations, oil platforms and weather-monitoring instruments in remote locations of the world. He stated that this type of satellite data should have a very wide range of energy and agricultural applications over the long term.

"The cost of solar cells has dropped from $100 per watt to $2 per watt since 1970, and it's expected to drop to one-third the current price by 2010," he said.

Newly accessible via the Internet, the SSE data set is available for anyone to use. You need only enter the latitude and longitude desired to receive a one-page printout on the available solar energy in their area. The global data set, a synthesis of information from several weather satellites, contains 52 monthly averages, in comparison to traditional individual measurements from isolated surface sensors. The data set can be accessed through the Langley Distributed Active Archive Center.

The new Internet site is designed to accommodate a range of computer system capabilities. For those users with more advanced systems, text files, color and contour plots on a global scale also are available.

"The release of this data to the Internet will not only help us answer questions faster, but will allow more specific advice to be given," said Campbell. "Solar cooking provides tremendous health, environmental and financial benefits to those who can use it. Better identification of target areas will help spread this powerful tool farther and faster than before."

As MTPE progresses into the next century, researchers will take advantage of all the latest data. Whitlock stated that by working with the energy and agricultural communities, he expects his team to create an improved data set that accounts for smoke from biomass burning, and to add quantities that are not included in the first data set. He expects that the additional quantities should enable new commercial applications in both the energy and agricultural industries.

The SSE data set was created by Langley and Analytical Services and Materials, Inc., Hampton, VA, under the sponsorship of NASA's Mission to Planet Earth enterprise. This office leads a long-term, internationally coordinated research effort to study the Earth as a global environmental system. ■

The goal of NASA's many outreach programs is to promote to the general public an understanding of how NASA makes significant contributions to American education systems and to institutions dedicated to improving science literacy. This newsletter provides one vehicle for reporting how applications and hardware used for space science and other NASA research and development can be adapted for use by teachers and their students and by non-NASA organizations.

Spacelink Unveils a New Look

Jerry Berg, Marshall Space Flight Center

Spacelink, an electronic resource specifically developed for use by the educational community, has been redesigned to make it more effective for teachers and students. Spacelink now features text and graphical interfaces, a powerful new search engine, improved navigation capabilities, and other enhancements that deliver information more efficiently. While Spacelink's primary purpose is to connect educators and students to NASA information, services, and materials, anyone with access to the World Wide Web is welcome to visit the site.

Educators can access materials chosen specifically for their educational value and relevance, including science, mathematics, engineering and technology education lesson plans; information on NASA educational programs and services; current status reports on Agency projects and events; and news releases and broadcast schedules for NASA Television. Spacelink also provides rapid and easy access to the information contained on virtually all public NASA Web sites.

NASA Spacelink began operating in 1988 and has grown to become one of the most comprehensive sources of NASA information, services, and materials. NASA Spacelink is an educational service offered by the Education Division at NASA Headquarters. Spacelink is maintained by the Education Programs Office at the Marshall Space Flight Center, and operational support is provided by the Information Systems Services Office at the Marshall Center.

NOTE: Due to directory changes, frequent Spacelink users may find that old bookmarks or links from other web sites no longer function. Visitors are urged to go directly to the NASA Spacelink Web page to update their bookmarks and cached links, or use Spacelink's new navigation capabilities to directly access areas of interest.

Learn more about Spacelink at <http://spacelink.nasa.gov/.index.html>. ■

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Mathaletes Converge on Washington DC

The nation's top seventh and eighth grade mathematics students traveled to Washington on May 9, each with the goal of becoming the number one junior high school "mathlete" during MATHCOUNTS, a national grassroots mathematics coaching and competition program sponsored by NASA. The 14th National Competition of MATHCOUNTS tested students' speed, precision and endurance.

Fifty-seven teams, representing all states, the District of Columbia, Puerto Rico, US Defense Department and State Department dependent schools worldwide, Guam, U.S. Virgin Islands, and the Commonwealth of the Northern Mariana Islands, competed. Prizes included a gold medal, $8,000, and a week at US Space Camp in Huntsville, Alabama.

Only ten students of the 228 team members participating in the National Competition qualified to compete for the title of 1997 MATHCOUNTS National Champion. These ten met in the final event, the Countdown Round, a fast-paced game-show-like competition that sets one calculating student against another. In this one-on-one oral elimination event, students race the clock and each other. They have up to 45 seconds to solve each problem, hit the buzzer and answer correctly. The Countdown Round lasts approximately 45 minutes.

The MATHCOUNTS program is the only program of its kind and is open to all public, private and parochial schools. Sponsors target seventh- and eighth-grade students to reach them at a critical time in their development and interest in mathematics.

Excerpted from NASA press release 97-90. ■

The goal of NASA's many outreach programs is to promote to the general public an understanding of how NASA makes significant contributions to American education systems and to institutions dedicated to improving science literacy. This newsletter provides one vehicle for reporting how applications and hardware used for space science and other NASA research and development can be adapted for use by teachers and their students and by non-NASA organizations.

1997 SHARP PLUS Apprentices Selected

NASA and the Quality Education for Minorities Network have selected 338 high school students as apprentices to engage in cutting-edge science and engineering research activities as part of NASA's SHARP PLUS Research Apprenticeship Program. Now in its fifth year, the SHARP PLUS program seeks to increase, strengthen, and diversify the pool of students for mathematics, science, and engineering college majors and careers.

SHARP PLUS also enables students, under the guidance of industry or university-based mentors, to spend eight weeks in residence at 16 universities that have joined with NASA and the Quality Education for Minorities Network. Chosen from over 1,300 applicants, this year's apprentices (215 female and 123 male students) represent 193 high schools and come from 29 states; Puerto Rico; the US Virgin Islands; Washington, DC; and a US military base in Germany.

The program is administered by the Quality Education for Minorities Network for NASA's Education Division, which is tasked to promote excellence in America's education system by involving the education community in endeavors to inspire American students, create learning opportunities, and enlighten inquisitive minds. The Quality Education for Minorities Network is a non-profit organization dedicated to improving the education of minorities and other underrepresented groups throughout the nation.

Excerpted from NASA press release 97-119. ■

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NASA Donates Computers to Empowerment Zone Schools

Sally V. Harrington, Lewis Research Center

Computers originally used by engineers and researchers at Lewis Research Center now will be used by students attending schools in the Cleveland Empowerment Zone (EZ). Lewis officially donated 100 computers to be distributed among ten schools in the EZ at a ceremony today attended by Cleveland Mayor, Michael R. White, and Cleveland Public Schools Superintendent, Richard Boyd.

"These computers will open windows to another world for our children and will help teachers prepare our kids for an ever changing future," said Mayor White. "Late last year NASA signed an agreement with our Empowerment Zone. Today we are seeing the fruits of that agreement. NASA recognizes that there is nothing more important than giving our children the best educational opportunities possible."

The donation of computers by Lewis was made possible by the Stevenson-Wydler Act, which enables educational institutions or nonprofit organizations to receive excess laboratory equipment from federal laboratories for the purpose of technical and scientific education and research activities.

"Lewis is committed to support Cleveland's 'strategic vision' for change,'" said Donald Campbell, director of the LeRC. "These computers will provide technology to educate the young minds that will carry that vision into the next century."

"It is a constant challenge to provide all of our students with computers and the latest high-tech teaching tools necessary for a modern education," Superintendent Boyd said. "Thanks to a little forethought by NASA's leadership, hundreds of students will use these computers to improve their reading and math skills. I hope other companies will follow NASA's example as they upgrade to more advanced technology."

"The agreement that we signed with NASA targeted science and mathematics education for school students living in the Empowerment Zone," said Mayor White. "EZ children will benefit from these computers. However, the ultimate beneficiary of this partnership with NASA is the City of Cleveland as we strengthen our ability to compete in the next century." ■

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Public Invited to "Land" on Mars

Marin County Fair goers can make virtual 'Mars landings' July 2 through July 6 at the NASA Mars Virtual Explorer Theater exhibit in the multimedia venue, the 'Cosmic Carnival.' The exhibit will be using the same software to remotely manuever a small robotthat is now in use by NASA scientists exploring the red planet during the ongoing Mars Pathfinder mission. Children from Marin County Schools were treated to a preview of the exhibit on May 16 when they praticed the virtual landings.

Exhibit producer, Yvonne Clearwater, of Ames Research Center (ARC), explained that the special NASA three-dimensional, virtual reality fly-through of the Mars landscape will allow fair-goers to 'land' on the Martian surface. The virtual Mars landscape was created from data sent back from the Viking spacecraft that landed on Mars. About a dozen ARC employees helped design and develop the exhibit, the Mars Virtual Explorer Theater.

"The old Viking Mars site is about 500 miles from the Pathfinder- Sojourner site," said Daryl Rasmussen, an ARC scientist who is also working on the ongoing Pathfinder mission.

"Around the time that NASA Pathfinder lands on Mars, July 4, up-to-the-minute mission status information will be offered on a NASA web site featured in the NASA display area. In addition, digital, interactive, behind-the-scenes interviews with various Mars mission scientists and engineers will be available," said Clearwater.

Other elements of the Cosmic Carnival, a free event, are the NASA Space Explorer multimedia section, videotapes, and pointers to more than a hundred NASA Web sites. The Space Explorer exhibit combines many of the audio, video, and graphical media elements of space exploration into an interactive game. Other components of the show offer a behind-the-scenes look at the people of NASA who conduct the science, and who design, build, and operate the world's largest space exploration endeavors. Also at the fair, the public will be able to access the site that is scheduled to immediately release the robot's, called Sojourner, images of Mars on July 4.

In addition to the exhibits, three astronauts are expected to attend the Marin Fair and make presentations on July 2 the Marin Center Showcase Theater. The scheduled astronauts are former NASA shuttle payload specialist, Millie Hughes-Fulford; Yvonne Cagle, a physician in the astronaut candidate training program; and former astronaut Russell Schweickart, who flew on the Apollo 9 Earth orbital mission in1969.

The exhibit will also travel to other fairs in California, Oregon, and Arizona from July through November. The Cosmic Carnival will be exhibited at the Washington County Fai/Rodeo(Hillsboro, Oregon), July 29 to August 3, the California State Fair, (Sacramento, California), August 16 to September 1, the Los Angeles County Fair, (Pomona, California), September 11-28, and Arizona State Fair (Phoenix, Arizona), October 16 to November 2, of this year. Special activities planned in conjunction with the Cosmic Carnival include a guest appearance at the Los Angeles County Fair in September by Ray Bradbury. A famous Mars meteorite provided by the Johnson Space Center will also be displayed at all the fairs.

Excerpted from NASA press release 97-39AR. ■

NASA's wealth of technology is being re-used in the fields of medicine, industry, and education and by the military to develop products and processes that benefit many sectors of our society. Spinoff applications from NASA's research and development programs are our dividends on the national investment in aerospace.

Robot "Brain Surgeon" Visits New York Convention

A robotic device, developed at the Ames Research Center (ARC), that could help surgeons avoid dangerous hemorrhaging during delicate brain operations, was unveiled at the Medical Design and Manufacturing Show at the Jacob K. Javits Convention Center in New York, New York, in June . The device also could lead to "smart" surgical tools that will increase the safety, accuracy, and efficiency of neurosurgical, exploratory surgical, and breast and prostate cancer surgical procedures. Other NASA medical innovations were also featured at booth 941.

"NASA invests more than $5 billion in technology development annually," said Michael Weingarten, NASA Headquarter's manager for business development. "It makes sense to bring that cutting-edge technology back to US taxpayers when such a huge investment is being made. Companies can work with NASA or with licensed NASA technicians in efforts that will lead to new company products."

Excerpted from NASA press release N97-38.

You can learn more about this robot brain surgeon and other NASA inventions from the NASA Commercial Technology Network. ■

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Using Mother Nature's Air conditioner to Keep Cities Cool

Dave Drachlis Marshall Space Flight Center

Using space-age technology, NASA researchers are studying how "urban forests" may allow cities to continuously grow while maintaining air quality and the environment, as well as lower cooling costs during sweltering summer months. Collaborating with ten Atlanta schools, the Atlanta Regional Commission, and the Environmental Protection Agency two NASA researchers from the Global Hydrology and Climate Center at the Marshall Space Flight Center began a study in Atlanta this week to learn how rapid urbanization affects temperature and air quality, and what can be done to lessen the impact.

The researchers, Jeff Luvall and Dale Quattrochi, are studying bubble-like accumulations of hot air, called urban heat islands, that have developed as Atlanta has grown during the past 20 years.

"Urban heat islands result when naturally vegetated surfaces are replaced with asphalt, concrete, rooftops and other man-made materials," said Quattrochi.

According to Quattrochi, the temperatures of artificial surfaces can be 20-40 degrees higher than those of vegetated surfaces. Materials, such as asphalt, store much of the Sun's energy and remain hot long after sunset. This produces a dome over the city of temperatures 5-10 degrees higher than air temperatures over adjacent rural areas.

"The more a city grows, replacing trees and grass with buildings and roads, the warmer it becomes, increasing peak power demands. To meet these demands, power plants must utilize fossil fuels to a greater extent, which ultimately have a negative impact on air quality," said Luvall.

In findings from similar studies, the two researchers found that city parks and other urban areas with trees and grass were cooler than parking lots and areas with a high concentration of buildings. According to Luvall, these 'green areas' are cooler because they dissipate solar energy by absorbing surrounding heat and using it to evaporate water from leaves, thereby cooling the air.

Urban forests also help cool cities by shading surfaces like asphalt, roofs, and concrete parking lots, preventing the initial heating and storage of heat. To determine where Atlanta's hot spots are, a Lear Jet equipped with thermal imaging equipment flew over the metropolitan area on May 11 and 12 taking heat images at mid-day the period of maximum heating and again 12 hours later when surfaces began to cool. On the ground, some Atlanta elementary students took part in the experiment by taking temperature and moisture readings of different surfaces at their schools in conjunction with the mid-day flight. The students will compare and verify their measurements with those recorded by instruments on the jet.

Information collected from the air study will allow researchers to understand the effect of tree cover,or lack thereof, on Atlanta's temperature and air quality. These findings also will provide Atlanta's urban planners a foundation to determine the benefits of developing and maintaining urban forests. Additional benefits may come from building plan that incorporate trees to shade roofs and reduce the heat load on houses and buildings, thus reducing power requirements. ■